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**STATE OF CALIFORNIA**  
**GOODWIN J. KNIGHT, GOVERNOR**

**REPORT**  
**on the**  
**TORRANCE AREA INDUSTRIAL WASTE SURVEY**  
**Los Angeles County, California**

**1954**

**LOS ANGELES REGIONAL WATER POLLUTION CONTROL BOARD (NO. 4)**  
**Los Angeles, California**

STATE OF CALIFORNIA

LOS ANGELES REGIONAL WATER POLLUTION CONTROL BOARD (NO. 4)  
ROOM 504 - SPRING-ARCADE BUILDING  
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July 1, 1954

Regional Water Pollution Control Board No. 4  
State of California  
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Gentlemen:

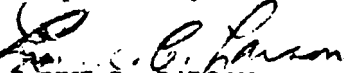
SUBJECT: Report on the Torrance Industrial  
Waste Survey, Los Angeles County, California

Transmitted herewith is a copy of the subject report. This survey and investigation was initiated by this office on July 31, 1953, as part of the Board's long-range planning to determine the nature and extent of water pollution sources within the Los Angeles Region.

In order to eliminate duplication of work and effort, and since the scope of this survey and investigation involved several local political subdivisions, the survey was coordinated by this office, with the Torrance Area Industrial Waste Survey Committee performing the work. This committee was composed of official representatives from the Cities of Los Angeles, Torrance, Redondo Beach, County of Los Angeles, State Division of Water Resources, State Division of Oil and Gas, and this Regional Board.

This report, which presents the findings and recommendations of this committee, is submitted for your review and consideration.

Respectfully submitted,

  
LORNE C. LARSON  
Executive Officer

LCL/mh

REPORT  
on the  
TORRANCE AREA INDUSTRIAL WASTE SURVEY  
Los Angeles County, California

Prepared for  
State of California  
Los Angeles Regional Water Pollution Control Board No. 4

By  
TORRANCE AREA INDUSTRIAL WASTE SURVEY COMMITTEE  
Los Angeles, California

June 1954

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### EXHIBITS

A - AREAL GEOLOGY	DIVISION OF WATER RESOURCES
B - GEOLOGIC SECTIONS	DIVISION OF WATER RESOURCES
C - GEOLOGIC SECTIONS	DIVISION OF WATER RESOURCES
D - GEOLOGIC SECTIONS	DIVISION OF WATER RESOURCES

## I. INTRODUCTION

This report presents the findings and recommendations of the Torrance Area Industrial Waste Survey Committee which in February 1954 completed a cooperative industrial waste survey of a 45 square mile portion of the Coastal Plain centering on the Torrance Oilfield in Los Angeles County. The survey was initiated by Regional Water Pollution Control Board No. 4 in July of 1953 as part of the Board's long-range planning to determine the nature and extent of water pollution sources within the Los Angeles Region.

Included in the survey were portions of five incorporated cities and several unincorporated sections of the County of Los Angeles. The committee consisted of representatives from each of these political subdivisions as well as the various State and local agencies concerned with water pollution. Members of the committee are listed below.

### Torrance Area Industrial Waste Survey Committee

Carl B. Johnston, Chairman  
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J. L. White  
Wayne Clark  
Loring Messier  
William Tibbett  
J. H. Ashley  
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State Division of Oil and Gas  
County of Los Angeles, Dept. of County Engr.  
County of Los Angeles Health Dept.  
City of Los Angeles Health Dept.  
City of Los Angeles, Bur. of Sanitation  
City of LA Dept. of Water and Power  
City of Torrance  
City of Redondo Beach  
City of Hermosa Beach  
City of Palos Verdes Estates  
LA County Flood Control District  
Regional Water Pollution Control Bd. #4  
Regional Water Pollution Control Bd. #4

## II. AUTHORITY

The survey was conducted under authority of Section 13055 of the State Water Code which reads, "A regional board may investigate any source of water pollution or nuisance within its region." Under Section 13052 of the Water Code, the Regional Water Pollution Control Boards have been empowered to formulate and adopt long-range plans and policies with respect to water pollution control, and to obtain coordinated actions of the various State and local political subdivisions of the State in the control of water pollution.

## III. FINDINGS

- 1) More than 57,000 barrels (42 gal/bbl) of highly mineralized oil field waste water (approximately 1800 gr/gal brine) are presently discharged each month into or upon the ground within the survey area. This total is made up of discharges at 130 separate disposal sites as listed in Table I and is based on brine production data reported to the Committee by the oil producers.

- 2) Five current waste discharges from industrial establishments (non-oil producing) are considered as creating a water pollution hazard. These discharges are the first five listed in Table IA.
- 3) The major portion of industrial waste produced within the area is currently discharged to the County Sanitation District's sewer system with ultimate disposal of wastes into the Pacific Ocean.
- 4) There are two reinjection wells operating within the area at the present time, returning a total of approximately 27,000 barrels of salt water each month to deep non-fresh water bearing zones.
- 5) Past discharges of oil brine into or upon the ground since the development of the Torrance Oil Field is conservatively estimated as totaling 30 million barrels which is equivalent to 150,000 tons of salt.
- 6) The survey area lies within the West Coast Basin and is underlain by valuable water bearing zones which furnish a major portion of water used within the area. Total pumpage from wells within the area approximates 13,000 acre feet per year (based on 1949-50 data from the Division of Water Resources).
- 7) There are approximately 100 active water wells within the area. Records show an additional 120 wells which are now abandoned or inactive.
- 8) Water in the deep fresh water aquifers within the survey area is generally of excellent quality, but pollution of these zones by oil brines has occurred in several localized areas.
- 9) Water quality of the shallow "200' sand" aquifer has been seriously affected by oil brines in the vicinity of Sepulveda Boulevard and Normandie Avenue.
- 10) Water quality records available to the committee show four water wells which have been seriously damaged by oil field waste water. Others have been affected to a lesser degree.
- 11) Geologic study of the area indicates that surface or shallow sub-surface disposal of mineralized wastes creates a serious pollution threat to the underlying water producing aquifers throughout most of the area.
- 12) The coastal portion of the survey area is presently being affected by sea water intrusion of the underlying water bearing zones. Experimental work is being conducted and a program is being formulated to correct this condition.
- 13) The State Division of Water Resources conducts a permanent sampling program which includes fourteen key water wells within the area. This sampling will detect future changes in water quality.

#### IV. RECOMMENDATIONS

- 1) That all discharges of oil brine to the ground surface, unlined sumps, or seepage pits be discontinued immediately. These discharges are listed in Table I.
- 2) That corrective action be taken in regard to the five industrial waste discharges listed in Table IA as pollution sources.
- 3) That continued efforts be made to obtain water well construction and abandonment legislation in order to reduce the problem of interflow between aquifers via improperly constructed or abandoned wells.
- 4) That the work outlined in above recommendations 1, 2 and 3 be accomplished through existing local enforcement agencies having jurisdiction, and the entire program be coordinated by the Regional Water Pollution Control Board.

#### V. BOUNDARY AND DESCRIPTION OF SURVEY AREA

The survey area covers approximately 45 square miles of the Coastal Plain and is bordered roughly by 190th Street on the north, Pacific Coast Highway on the south, Main Street on the east, and the Pacific Ocean on the west. It includes all or portions of the following political subdivisions: Cities of Los Angeles, Torrance, Redondo Beach, Hermosa Beach, Palos Verdes Estates, and the County of Los Angeles. Included with this area is the Torrance Oil Field and numerous industrial establishments of varied nature.

#### VI. SURVEY PROCEDURE

The survey consisted of an inventory of all significant industrial wastes produced within the area and a study of water quality in the underlying water producing zones as related to past and existing waste discharges.

Industries located in the City of Los Angeles portion of the area were surveyed by representatives of the City of Los Angeles Bureau of Sanitation, Los Angeles City Health Department, and the Sanitary Engineering Division of the Department of Water and Power. In unincorporated areas survey data was furnished by the Los Angeles County Engineer, Industrial Waste Division. Field work in the remaining incorporated cities within the area was accomplished by the staff of Regional Water Pollution Control Board No. 4 in cooperation with the committee members from these cities. Representatives of the Los Angeles County Health Department aided in the survey within the City of Torrance and the State Division of Oil and Gas furnished information on oil brine production and reinjection well operation within the area.

More than 250 industrial establishments were surveyed and from the information obtained, a tabulation of significant waste discharges which may affect water quality within the area has been made. (See Tables I and IA). The original field investigation forms on all discharges are on file in the offices of Regional Water Pollution Control Board No. 4.

Water quality and geologic information was obtained principally from the State Division of Water Resources which in the past has made extensive studies of the area. Further information was obtained by recent water well analyses furnished by the Los Angeles County Flood Control District, Los Angeles Department of Water and Power, California Water Service Company, and field sampling by survey personnel.

## VII. GEOLOGY AND HYDROLOGY

The major portion of the survey area (approximately 70%) is a low lying poorly drained area which is part of what is commonly referred to as the "Torrance Plain." The only high ground in the area is that found along the coastal belt of stabilized sand dunes which separate the Torrance Plain area from the Pacific Ocean and the small portion of the survey area along the north flank of the Palos Verdes Hills.

### Surface Drainage

Surface runoff and drainage from the area may be divided into the following four general classifications. These areas are delineated in "Exhibit A".

Area 1 - The belt lying west of the ridge line of the coastal sand dunes comprising approximately seven square miles or 15% of the total survey area. This area drains to the Pacific Ocean.

Area 2 - The north central portion of the area comprising most of the business and industrial section of the City of Torrance which drains to the Los Angeles County Flood Control Districts "Torrance System" which extends eastward to Dominguez Channel. It is approximately 7 square miles in size or 15% of the survey area. Runoff to the "Torrance System" ultimately discharges to Dominguez Channel but during normal rainfall periods the water remains within a slough area extending eastward from the Torrance Blvd.-Western Avenue intersection and either evaporates or percolates into the ground. The water impounded in this slough has in the past created a mosquito breeding problem.

Area 3 - The northeastern portion of the survey area which drains directly into Dominguez Channel and eventually to Los Angeles Harbor. This comprises only a very small percentage of the survey area.

Area 4 (and 4A) - The southern part of the survey area drains generally to Bixby Slough but contains areas of internal drainage, mainly in the westerly portion designated as Area 4A in Exhibit A. Water or liquid wastes discharged to the ground in these local areas have no outlet except through evaporation and possible deep percolation into the underlying aquifers. This area comprises more than 65% of the total survey area and contains the major portion of industrial waste discharges.

### Surface Soils

The western and part of the central portion of the survey area are covered by a light dune soil which is highly permeable. (See Exhibit A) This sand is of considerable thickness along the coastal sand dunes and thins rapidly to the eastward extending in certain areas as far as Western Avenue. Throughout much of the brine disposal area within the City of Torrance this dune soil is underlain by "hardpan" (cemented sand) at depths varying from five to fifteen feet. During periods of high rainfall a small amount of ground water is usually found immediately above this hardpan. This relatively impermeable barrier resists deep penetration of surface waters but it is not continuous throughout the area. Many cesspools and seepage pits in the area have been drilled through the "hardpan" and into the more permeable structure below, a condition which undoubtedly accelerates flow of water from the sandy surface soils through the hardpan.

In the dune sand area just east of the eastern boundary of Redondo Beach and extending from Sepulveda Boulevard to about Del Amo Street there is apparently little resistance to percolation of surface water into the merged water bearing aquifers. This area has been tested by the Los Angeles County Flood Control District as a spreading site for reclaimed waste water and found to be satisfactory. This area is near the sea water intrusion "front" which reportedly extends inland approximately to the eastern boundary of Redondo Beach in the vicinity of Del Amo Street. The oil brine discharges in the area underlain by ground water affected by sea water intrusion must still be considered as pollution sources inasmuch as corrective action to reclaim these degraded areas is being taken.

The area to the north and west of the central part of Torrance has a soil characterized by a light to medium textured surface layer 1' to 2' thick which overlies a clay or clay loam subsoil.

Between the surface soils and the water producing 200 ft. sands are found layers of sand and clay of varying thickness and permeability. Geologic information indicates that the clay layers are not continuous and therefore serve only to impede downward flow of water rather than prevent such flow.

### Water Producing Aquifers

The four principal water producing aquifers of the area are the "200 ft. Sands", Gardena, "400' Gravel", and Silverado zones.

"200 Ft. Sands": This is an aquifer of relatively low permeability which extends throughout most of the area at depths of 25 to 100 feet below ground surface with thickness of the aquifer varying from 25 - 100 feet. It is not a heavy water producer and only a few wells are still pumping from this zone. In the area south of Torrance and along the north flank of the Palos Verdes Hills this zone merges with the underlying aquifers. (See Exhibits B, C, D, for geologic cross sections)

Gardena: The Gardena Water Bearing zone is found in the northwest corner of the survey area at the same depth as the "200 ft. Sands". This confined zone comprises a coarse fluvial deposit laid down in an ancestral river channel, which merges with the Silverado and "400 ft. Gravel" zones in the north central and northwesterly portions of the survey area. Water production from this aquifer is considerably greater than from the "200 ft. Sands."

"400 Ft. Gravel": In the northeast corner of the survey area the "400 ft. Gravel" exists as a separate aquifer at depths varying from 200 to 400 feet below ground surface. Throughout the rest of the area however, it merges with the underlying Silverado zone.

Silverado: The Silverado zone is merged with the "400 ft. Gravel" in most of the area and is found at a depth of approximately 200 ft. As shown on the geologic cross sections in Exhibit B this aquifer is in direct hydraulic continuity with the "San Pedro Sands" which rise to the surface along the north flank of the Palos Verdes Hills. The gravel deposits in this area are surface evidence of existence of these "sands."

The Silverado and the "400 Ft. Gravel" water bearing zones are the heaviest water producing aquifers of the area .

## VIII. WASTE DISCHARGES AND THEIR EFFECTS

### 1. Oil Field Waste Water

The survey disclosed that at the time of writing this Report there are 130 locations within the survey area where oil brine is discharged to the ground. The discharges total 57,235 barrels per month of approximately 1800 gr/gal. brine and are distributed over a large area as indicated on Plate I. Typical analyses of these brines follow:

#### Typical Analyses Of Oil Brines- - - Torrance Oil Field

	<u>Sample #1</u>	<u>Sample #2</u>
TDS (approx.)	30,000 ppm	30,000 ppm
Ca	560 "	292 "
Mg	280 "	120 "
Na	9,760 "	11,000 "
K	140 "	
Cl	22,000 "	16,800 "
SO <sub>4</sub>	0 "	0 "
HCO <sub>3</sub>	-	1,000 "
Fe total	-	3.1 "
B	65 "	
Ba	5 "	
Date Col.	1-29-54	2-2-53

Notes: Sample #1 is composite of 20 plus wells in Sepulveda-Normandie Boulevard Area. Anal. by LA W&P  
Sample #2 is composite of 2 wells in Sepulveda-Hawthorne Boulevard Area. Anal. by State Health Dept.

Since past discharges must be considered when evaluating effects on ground water it is estimated that brine discharged to the ground prior to 1940 when the first major dischargers connected to the sewer totaled approximately 150,000 bbls/mo. In the period since 1940 a number of these discharges have been diverted from the ground to the sewer system, or the brine has been reinjected into non-fresh water bearing zones.

An attempt has been made to estimate the approximate total of brine discharged since the development of the oil field in 1923. From data available it is estimated that more than 30,000,000 barrels containing 150,000 tons of salt has been added to the ground within the Torrance Oil Field Area during the past thirty years.

## 2. Industrial Wastes from Manufacturing Industry

The survey disclosed that a major portion of wastes produced by industry other than the oil producers is presently discharged to the sewer with ultimate ocean disposal or is discharged under conditions which preclude a water pollution hazard. Of the 90 industrial establishments surveyed 29 were found to be disposing of wastes by means other than connection to a community sewer. These industries are listed in Table IA with appropriate remarks made as to the significance of each waste.

Five waste discharges from this group require immediate correction. Two additional discharges are listed as capable of creating nuisance conditions in the future and should be kept under surveillance. The remainder of the wastes are discharged under existing permit, at approved dump sites, or are of an insignificant nature.

It was not found that any of the above wastes has as yet had a deleterious effect on the underground waters of the area.

## 3. Probable Movement of Pollutants

Once discharged to the ground the only way for the salt contained in the oil brines to leave the discharge areas would be by percolation into the ground or by transfer with storm water runoff. A study of surface drainage characteristics indicates that only a small portion of the salt could have been removed to points outside the survey area in this manner although within the survey area there are a number of places where runoff could cause localized concentrations of salts.

Bixby Slough, into which most of the oil field area ultimately drains, does not show any marked effect of mineralization traceable to the brines. Bixby Slough water normally contains approximately 1000 ppm of total dissolved solids with chlorides of roughly 300 ppm. The mineralization of this slough is of course increased by the concentrating effects of evaporation.

As mentioned previously, layers of clay retard downward percolation of surface waters throughout most of the area. The fact that these clay layers do not form an effective seal against downward movement of pollutants is evidenced by the instances where serious breakthrough to fresh water aquifers has occurred.

However, only a small portion of the total salt discharged to the ground in the area has reached the water bearing aquifers and it must therefore be assumed that most of the salt has remained in the ground near the surface or in the upper non-water producing zones of the area.

It is certain that in time much more of this salt will reach the water producing aquifers.

4. Effect of Oil Brines on Deep Water Producing Zones

For the past twenty years the direction of ground water travel in the principal aquifers underlying the area has been eastward. Under native conditions the flow would be in the opposite direction but heavy pumping has caused an overdraft resulting in a landward movement of water contained in the gravels underlying or adjacent to the Pacific Ocean. These conditions have created the sea water intrusion problem which at the present time is receiving a great deal of attention.

With the ground water flow being eastward it would appear that any general effect of the subject waste discharges would be first noted in the area to the east, although it must be mentioned that the geological character of the area is such that the direction of flow of any particular pollutant is extremely difficult to determine. Also, heavy pumping of ground waters in localized areas causes variable ground water movement which affects travel of pollutants.

An analysis of past sample results shows quite conclusively that in the area to the east of the major discharges the deep water producing zones (400' Gravel, Silverado) of the area have not been affected. This statement is based on the fact that the majority of wells pumping from this zone have shown no tendency toward an increase in chloride ion concentration over the past 20 years. Chloride ion concentration approximates 20 ppm in this area with total dissolved solids being in the 250 to 300 ppm range.

In the area along the eastern boundary of the City of Redondo Beach the sea water intrusion problem has obscured the effects of the considerable quantities of oil brine discharged in this highly permeable area. It is possible that these brines are at least in part responsible for the high mineralization of the underground waters in the vicinity of the Redondo Beach boundary at Del Amo Street. It is conservatively estimated that more than 5000 barrels per month of oil brine has been discharged in the immediate vicinity ( $\frac{1}{4}$  mile radius) of this degraded area during the past 20 years. At least an additional 5000 barrels per month has been similarly discharged within a radius of one mile from the area. The similarity between the mineral content of the brine and sea water prevents the definite determination of the source of the pollutant (s) responsible for the ground water degradation in this area.

In the southern part of the area along the flank of the Palos Verdes Hills from the Walteria area to beyond the eastern boundary of the survey area (Main Street) water pumped from the merged 200' Sand,

400' Gravel, and Silverado zone is somewhat more highly mineralized with total dissolved solids varying from 700 to 1000 ppm and chlorides of 100 to 150 ppm. A comparison of past and present analyses shows that in many wells in this area the mineralization has remained fairly constant over a period of years.

Division of Water Resources and USGS data suggests that the higher salt content in the eastern part of this area may have as its source the more highly mineralized waters found to the south in the Gaffey syncline area. These waters have been affected by natural sources of mineralization. In addition to this source of mineralization there is a distinct possibility that industrial waste discharges directly into gravel outcroppings along the flank of the Palos Verdes Hills are also exerting effect.

Prior to 1951, major discharges of oil industry wastes into the Torrance Gravel Pit southeast of the town of Welteria were made although the exact nature and volume have not been determined. Geology of this disposal site is such that pollution of the underground aquifers is highly probable as the gravel outcroppings in the area appear to be in direct continuity with the Silverado water bearing zone.

A sample from one well in this area, No. 281 F (4S 14W 35F2) showed a total solids content approximating 1000 ppm and a sulfate ion concentration of 255 ppm. Quality of this water, especially the high sulfate content, does not compare with that of surrounding wells. The well is located approximately 1.5 miles east of the above mentioned Torrance Gravel Pit. Runoff from the hill area to the south may be affecting water quality in this area.

The shallow "200 ft. Sand" water bearing zone merges with the lower aquifers in this general area and the poorer quality water of these sands may be adding to the mineralization of the merged zones. The lack of active water wells hampers determination of the general water quality of the "200'sands" but it may be safely assumed that it is somewhat more highly mineralized than the Silverado Zone. Instances of serious pollution of this zone are discussed in subsection 5 of this chapter.

In conclusion it appears quite probable that the general high mineralization of the merged zones along the north flank of the Palos Verdes Hills is derived from both natural sources and effects of industrial waste discharges.

In the area north of Welteria well (747N) (Nestor), pumping from the merged "400 ft. Gravel" and Silverado Zone was seriously polluted by oil brine in 1952. It was determined that this was a localized condition with the brine from surface disposal sumps probably reaching the water producing zone by flow along the outside of the casing of the well itself. This is an example of well construction which allows ready transfer of upper zone waters into the lower aquifers. Although this well has since been abandoned by filling with clay, it is doubtful that the flow of brine into the merged "400' Gravel" and Silverado Zone has been stopped as sealing of the annular area outside the casing was not accomplished.

In the same area another well pumping from the same zone (No. 746) shows a definite trend toward increased mineralization with chloride gradually rising from 50 to approximately 325 ppm over the past 25 years. Hardness of the water produced from this well now averages about 280 ppm, which is much higher than an assumed native water hardness of less than 150 ppm.

A partial list of sample results from this well follow:

<u>Water Well No.</u>	<u>Date Sampled</u>	<u>TDS</u>	<u>Chlorides</u>	<u>Hardness(CaCO<sub>3</sub>)</u>
746	6-17-26		50 ppm	
	3-5-41		139 "	
	12-28-44		174 "	
	8-5-46	700 ppm	189 "	272 ppm
	4-11-50	840 "	253 "	306 "
	7-11-52	875 "	305 "	282 "
	9-14-53	990 "	324	

The above tabulation shows that the water quality is fast approaching a point where the well will become unusable for domestic purposes. Present usage is for both domestic and industrial service.

This well is located in close proximity to a number of active brine disposal sumps as shown on Plate I. It should be mentioned that there were many more such brine sumps in the same area until recent years. All available evidence indicates that the well is being polluted by oil brines but whether this is due to the active or inactive sumps, or both, can not be determined.

##### 5. Effect of Oil Brine on "200 Foot Sands"

Although the preceding discussion has been limited to effects on the lower (Silverado, "400 ft. Gravel") water bearing zones it is evident that the upper water bearing zone referred to as the "200' Sand" has also been seriously affected by brine discharges. This zone extends throughout most of the survey area at depths of 25 to 125 feet and varies from 25-100 feet in thickness. Samples from two presently inactive wells (Nos. 798G & 798F) show that this aquifer has been polluted by oil brines in the vicinity of Sepulveda Blvd. and Normandie Avenue. These wells are located just east of major brine discharges in the City of Los Angeles and Torrance. Results of samples from these wells are tabulated below.

<u>Well No.</u>	<u>Date</u>	<u>Chlorides</u> <u>(ppm)</u>	<u>Well No.</u>	<u>Date</u>	<u>Chlorides</u> <u>(ppm)</u>
798F	12-17-43	146	798G	12-17-43	390
"	3-24-48	1722	"	11-2-44	519
"	9-21-49	2826	"	11-8-45	594
"	4-17-50	3090	"	11-9-48	564
"	1-2-51	3304	"	4-18-50	628
"	12-2-52	4750	"	1-2-51	792

Geologic reports and well logs show that the "200 ft. Sand" aquifer is not continuously separated from the lower zones and that merging of the aquifers occurs in the area south of Torrance and along the north flank of the Palos Verdes Hills. Inasmuch as the highly mineralized brine has reached the "200 ft. Sand" level it has increased chances for lateral dispersion which increases greatly the probability of reaching a point which allows entrance to the lower zones. In addition to normal seepage channels, water can reach the lower zone through improperly constructed or abandoned water wells. This latter condition concerns the committee and definite recommendations are made for water well construction and abandonment legislation aimed at retarding interflow between aquifers as much as possible. The many oil wells in the area also pierce the fresh water zones but construction and abandonment of these wells has been under the jurisdiction of the State Division of Oil and Gas since development of the Torrance Oil Field.

6. Possible Effect of Wilmington Oilfield

In the southeast portion of the area shallow wells produce a water somewhat more highly mineralized than found elsewhere in the aquifer. Whether the increase is due in part to past waste discharges has not been determined but it appears logical to assume that this has been the case. A more complete study of the area to include the adjacent Wilmington Oil Field Area appears necessary before conclusions can be drawn regarding this condition. It is known that surface disposal of brine was a common practice in the Wilmington Oil Field prior to 1949. Since that time much of the brine has been diverted to the sewer system.

7. Economic Effects of Increased Mineralization of Underground Waters

In the discussion of the effects of industrial waste disposal on the underground waters an attempt has been made to present data which clearly shows that waste discharges are presently polluting the underground water and that further degradation can be expected in the future. The eventual total damage to the underground waters cannot at this time be determined but the possibility of extensive damage is evident.

Present California water pollution control legislation empowers regional boards to consider the economic effects of a waste discharge reaching waters of the State. Excessive mineralization of ground waters to the extent that such waters require treatment before domestic or industrial use may be termed an adverse effect of waste disposal, depending on the degree and extent of the particular pollution. Discharge of wastes high in sodium may so unbalance the sodium-calcium ratio of the receiving waters as to make such waters unsuitable for irrigational use. Likewise the presence of boron in more than a few parts per million and chlorides in excess of a few hundred parts per million may seriously impair plant growth, particularly in poorly drained soils. Waters containing excessive boron or chlorides are not economically treatable except by dilution.

Within the range of quality from that of the "natural" water to that which is unusable for any purpose the cost of treatment or correction of a given water is roughly proportional to the content of objectionable constituent (s). Dr. Richard Pomeroy, in Appendix C to a "Report Upon The Collection and Disposal of Refuse in the County Sanitation Districts of Los Angeles County, California", assesses the cost of hardness in a domestic water supply at a figure between 5¢ and 8¢ per pound. Using hardness (at 5¢ per pound) as an example, an increase of 10 ppm of hardness in a well producing 1 MGD could cost 4.15 per day. On a broader scale, if a 10 MGD underground supply were increased 100 ppm in hardness the annual cost due to hardness alone would be approximately \$150,000.

If a typical 1 MGD well becomes unusable and must be abandoned, the economic loss includes the remaining undepreciated value of the well plus the cost of replacing the supply with imported water. The former might reasonably be half the estimated \$10,000 original cost of a 12" well, 500 ft. deep, with piping, pump, and equipment; or \$5000. The value of the "lost water" is computed as the difference between the cost of imported water (\$20 per acre foot) and the cost of pumping local water if it were available (\$5 per acre foot), or a net cost of \$15 per acre foot. In this hypothetical case of a 1 MGD well polluted to the point of abandonment the immediate economic damage is \$5000 plus \$16,700 per year, without considering costs of proper sealing of the well or increased mineralization which may spread through the polluted aquifer to other wells. To a private well owner or farmer beyond reach of imported water the loss of his only water source by underground pollution becomes extremely serious.

#### 8. Costs of Alternate Waste Disposal

The total overall cost of correcting the 130 brine discharges from a total of 260 oil wells causing a pollution threat within the survey area cannot be estimated without a detailed study of each case. However, if the entire 57,000 bbls/mo. were to be hauled to legal disposal points (an extreme case) the total annual cost, at the current rate of 12¢ per barrel, would be \$68,000. Thus, based on the most costly long term means of brine disposal, the annual cost of disposal for the "average" (as related to brine production) oil well would approximate \$300.

The "average" oil well in this group produces 2500 barrels of brine per year. If this brine reached a ground water supply it could destroy for beneficial use up to 100 times its volume or approximately ten million gallons of water. At \$15 per acre foot the present value of 10 million gallons of water would be \$450.

The above discussion is by no means a complete analysis of conditions existing in the area, but it does show that the amount of possible damage to the water supply is sufficient to warrant the expense of correcting the brine discharges.

## IX. PUBLIC HEALTH CONSIDERATIONS

Several conditions were disclosed during the survey where waste discharges were creating problems of concern to the Public Health agencies. Appropriate action has been or is being taken by these agencies. One case concerns surface disposal of sewage from an industrial plant in Torrance and another the industrial waste water which reportedly ponds in the slough area east of Torrance and seriously hampers mosquito control operations.

All local sewage disposal facilities within the area are under the jurisdiction of local Health and/or Plumbing Departments.

## X. ELIMINATION OF PRESENT WASTE DISCHARGES

In the five months since the survey was initiated a number of former waste dischargers have stopped disposal of wastes onto the ground within the survey area. This action has been taken voluntarily as the result of contacts made during the field investigations conducted by the Committee. The past actions of the County Engineer in eliminating waste discharges within unincorporated portions of the area has greatly encouraged action in areas under separate jurisdiction although in a few instances prohibiting discharges in one zone has resulted in disposal of wastes by hauling to another area where waste disposal requirements are not in effect. This points up the need for waste disposal control throughout all the political subdivisions concerned.

Table I lists 130 discharges which should be corrected. A number of these (estimated at 20 to 30) can be readily corrected by connection to existing sewers. Haulage of wastes would appear practical in a number of instances (estimated at 50). Some oil operators in the area, especially in unsewered parts of the City of Torrance, are faced with the problem of economic justification of haulage of brines as compared to construction of long sewer connecting lines or other means of disposal.

At one time the oil producers in the area attempted to solve their waste water problems by means of a joint waste disposal system but such a system has not been created and recently many of the operators have constructed their own separate facilities. The joint plan encompassed practically the entire oilfield and as such proved to be too costly in the opinion of many operators. It is believed that further attempts at organizing joint disposal systems should be based on limited areas within the oilfield.

In working toward elimination of all discharges within the area the Committee hopes that the information contained in this report will aid the oil operators in determining satisfactory and economical methods of waste water disposal.

## XI. SEWERAGE FACILITIES

A major portion of the area is sewered with ultimate disposal of waste into the Pacific Ocean. However, the sewer system does not completely cover the area, resulting in several areas where sewers are badly needed to handle domestic and industrial wastes. The most critical of these in respect to industrial waste disposal is the area covering the western and southern

portions of Torrance in which are located numerous brine discharges. A new 30" sewer line extending westward along Lomita Boulevard is now under construction. This line will enable sewerage of several major brine discharges in the vicinity of the Hawthorne and Sepulveda Boulevard intersection.

## **XII. FUTURE DEVELOPMENTS**

In any rapidly developing area such as that covered by the survey, changes affecting waste disposal requirements must be considered. This section will discuss possible future developments as they relate to waste disposal.

One of the principal considerations is the "life" of the Torrance Oil Field which has now been active for approximately thirty years. In recent years production from many wells in this field dropped to a point where operation was not economically feasible and the wells have been abandoned or inactivated. Most of the remaining wells are low producers with a questionable economic "life" although recent redevelopment of a number of these wells has resulted in a relatively high rate of production. Changing property values and the price received for oil are the most important factors affecting the life of wells in this field and of course this makes any estimate of the life of the field sheer guesswork. However, it appears likely that a major portion of the presently producing wells within the field will be inactivated in the foreseeable future causing a gradual drop in total brine production over the next several decades.

Industrial expansion of the area is expected to continue at a rapid rate, resulting in the discharge of more waste products. Most of this waste will be discharged to the sewer systems but as the area develops and sewer flow rises increased need will be felt to eliminate non-pollutional wastes from the sewer by discharging locally into or upon the ground. These future discharges will be under control of the various agencies having jurisdiction and the basic data contained in this report should aid in establishing limiting concentrations or conditions of discharge.

As mentioned in Section VII of this report a major portion of the water now consumed within the survey area comes from local wells which produce an excellent quality water. The sea water intrusion problem of the West Basin is evidently going to require a reduction in pumping of this water with a corresponding increase in use of Colorado River water in future years. This water is somewhat more highly mineralized than the ground waters now used and its effect on the ground waters through deep penetration from the surface must be considered when placing limiting concentrations or conditions on waste discharges. Use of Colorado River water in the recharge areas outside the survey area will also affect water quality of the underground aquifers.

An interesting future development within the area will be the probable effect of past brine discharges on the underground water zones. As mentioned in Section VIII a number of instances of pollution of these aquifers have already been noted and considering the "lag" time between

the start of brine discharge and discovered pollution in these cases it is certain that more underground water will be adversely affected in the future.

It is evident that the present underground supplies will in future years become increasingly valuable and that their protection from pollution by wastes must be a continuing concern to the community.

TABLE I

TORRANCE AREA INDUSTRIAL WASTE SURVEY  
Oil Brine Discharged Into or Upon The Ground

LOCATION (Plate I)	JURIDICTION	DISCHARGER	OIL WELL	QUAN. BRINE BELS/MO.	TYPE DISPOSAL	REMARKS
788-4	Torrance-RWPCB#4	Atlantic Oil Co.	D & W 1	345	Unlined sump & ground	
778-11	"	Belmont	Allen K 1	400	" " "	
788-12	"	Cal. So. Oil	# 5	250	Seepage Hole	Sewer conn. planned
788-13	"	" " "	# 6	1600	" "	
778-27	"	" " "	# 7	305	" "	
788-15	"	" " "	# 9	250	" "	
788-10	"	" " "	# 10	245	" "	
773-7	"	" " "	Gypsy 1	770	" "	
788-8	"	Crabtree-Zing	Cam-Cowan 1	500	Unlined Sump	
778-9	"	H. T. Davis	Fee 1	30	Ground Surface	
778-19	"	" "	Paso 1	25	" "	
788-24	"	K. H. Day	Bell 22	220	" "	
788-16	"	"	Watkins 1	450	Unlined Sump	
788-7	"	"	Washburn 1	275	" "	
788-5	"	"	Darnell 1	355	Ground Surface	
788-22	"	"	Moldum 1	90	" "	
765-2	"	Emerald Oil	Stock Com. 2	120	" "	
777-2	"	Eyer Brothers	# 1	750	Unlined Sumps	2 Adjacent Sumps
747-1	"	"	#4	1000	Ground Surface	
788-1	"	Graner Oil	Wilson 2	1500	Unlined Sump	Anal. 14,500 ppm cl
745-2	"	Jasp & Hunter	Freng. 1,3,4,5	300	" "	
788-6	"	F. C. Kelley	Benson 1	100	" "	
778-6	"	"	Huyck 1	200	" "	
778-15	"	G. A. Kelley	Beebe 1	75	" "	
756-1	"	E. B. Kenney	# 1	120	" "	
777-3	"	"	# 3	250	" "	
788-31	"	J. K. Kesson	Kern 2	150	" "	
788-32	"	Kern Petro. Co.	Mad. 1, Neher 1	250	" "	Not verified
778-8	"	Kesson-Snyder	Stokes 1	90	" "	
788-21	"	" "	Baas 1	215	" "	
777-4	"	H.W. Killingsworth	Lease 4-1	1350	" "	

TABLE I CONT'D.

LOCATION (Plate I)	JURISDICTION	DISCHARGER	OIL WELL	QUAN. BRINE BBLs/MO.	TYPE DISPOSAL	REMARKS
778-20	Torrance-RWPCB#4	W. M. Killingsworth	Robinette 1	150	Seepage Pit	
755-1	"	"	Day lease 1	15	" "	
757-1	"	"	Cun'ham 1,2,3	90	Ground Surface	Corrected
788-19	"	"	Bel-Pat 1	15	" "	
788-2	"	L M S Oil	Ellis 1	75	Unlined Sump	
788-14	"	A. J. Loudon	# 1	5	" "	
788-11	"	"	# 2	5	" "	
745-6	"	Miller & Miller	Miller 1, 2	200	2 Unlined Sumps	Adjacent Sumps
756-3	"	"	Miller 3	300	Unlined Sumps	
778-21	"	"	Miller 4	230	10' Seepage Pit	
788-23	"	"	Miller 5	180	" "	
778-3	"	McDonald-Burns	8 Wells	3000	2 Unlined Sumps	Adjacent Sumps
788-29	"	Moore Oil	Moore 1	15	Ground Surface	
788-3	"	Morton & Dolley	Comp. 1	830	Unlined Sump	
778-5	"	"	Hamp. 1	800	" "	
756-1	"	Morton-Kahlbush	Tor. holding 1-5	630	" "	
788-3	"	"	Kettler 6	170	" "	
778-1	"	"	Ellis Kelley 1	580	" "	
798-1	"	O'Donnell Oil	#30, 28, 29	600	" "	Well #29 in L.A.
778-2	"	O M Oil	Post Houts 3	200	Ground Surface	
778-1	"	"	Barto 1	120	" "	
746-1	"	Pac. American Oil	Fee 1-5	740	Unlined Sump	
746-1	"	"	Smith Com 1	225	" "	
748-16	"	Pac. Western Oil	20 Wells	3600	" "	17,600 ppm cl
747-5	"	Patton-Conaway	Empire 1	3000	" "	
77-25	"	H A Pegors	Pegors 2	450	Ground Surface	
788-30	"	Petrol. Midway	Grif. 8	15	Unline Sump	Unverified
787-3	"	"	Peters 9	15	" "	"
778-10	"	J. E. Pettijohn	Koala 1	30	Hauled ?	
788-26	"	P H & B Oil	# 70	1500	Unlined Sump	
788-25	"	"	#71	120	Seepage Pit	Excess hauled
778-23	"	"	# 73	175	" "	
778-24	"	"	# 74	1100	Unlined Sump	
789-1	"	Rippy Robinette	Spring 1, 2	235	" "	
788-33	"	Earl Robinette	Tiger	240	" #	
789-3	"	CO & LM Rodabaugh	Rilling 1	40	Conc. Cellar	

TABLE I CONT'D

LOCATION (Plate I)	JURISDICTION	DISCHARGER	OIL WELL	QUAN. BRINE BBLs/MO.	TYPE DISPOSAL	REMARKS
778-2	Torrance-RWPCB#4	CO & LM Rodabaugh	Wertalla 1	150	Unlined Sump	
778-28	" "	CO Rodabaugh	McHenry 1	30	" "	
788-20	" "	"	Davidson 1	3000	" "	
788-27	" "	Thelma Russel	Aut 1, Clark 1, Scot 1	125	" "	
788-28	" "	S & B Oil	# 2	180	" "	
788-17	" "	W. J. Sargent	Lindis 1	170	" "	
778-26	" "	Secunda Oil	Wells 1	100	" "	Corrected 4-1-51
745-4	" "	Sierra Oil	Sierra 9	60	" "	
745-3	" "	" "	Cantrell 1, 2	140	" "	
745-5	" "	" "	Sierra 10-12	180	" "	Anal. 21,500ppm c.
725-1	" "	Texas Co.	Red Imp. 1-10	890	2 Unlined Sumps	Excess hauled
734-2	" "	Virmark Oil	Dom 1-34	10	Unlined Sump	
778-17	" "	ViRoi Oil	Lyman 1	250	" "	
778-18	" "	" "	Baxter 1	100	" "	
757-2	" "	Weber Butler	Dearborn 1, WB 1	2300	Seepage Pit	
787-1	" "	L C West	West 1	125	" "	
735-1	" "	Wood-Callahan	13 Wells	1600	Unlined Sump	Anal. 22,500ppm c.
777-1	" "	Woolner Oil	# 5	65	" "	
778-14	" "	" "	# 3	40	" "	
788-9	" "	" "	# 9	10	" "	
724-1	RB - WFB 4	C & G Oil	Feel, Tujax 1, 2	550	2 Unlined Sumps	Adjacent Sumps
724-2	" "	Graner, Oil	# 3, King 2	1200	Unlined Sump	Sewer Conn. Plann.
724-3	" "	A. S. Johnston	7 Wells	2700	" "	Brine hauled from
723-1	" "	Marble Petroleum	102, 103	500	" "	
726-1	" "	J. M. McNeil	Rico 1-10	750	Ground Surface	Spr. on Roadway
714-1	" "	G. Milligan	# 1	10	Unlined Sump	
725-2	" "	Zenith Oil	1, 2, 3	60	" "	
704-1	HB - WFB 4	Westwood Oil	# 1	50	Seepage Pit	
704-2	" "	J. L. O'donnel	32-33	250	" "	

TABLE I - CONT'D

LOCATION (Plate I)	JURISDICTION	DISCHARGER	OIL WELL	QUAN. BRINE BBLs/MO	TYPE DISPOSAL	REMARKS
290-1	City of Los Angeles	Airline Oil	Herwick 1	460	Ground Surface	5-1-54 Con. to sewer
799-1	"	Axis Petroleum	J 1	100	"	"
320-1	"	Delaney Petroleum	Com 909-1, 3	900	Unlined Sump	
798-1	"	Kelley & Kelley	Logan 1	1000	Ground Surface	
797-1	"	Bernard Lemohn	# 2	240	"	Some hauled
300-3	"	Lespring Oil	# 1589	100	Unlined Sump	
300-1	"	"	Kupfer 1	100	"	
300-2	"	"	Kupfer 2	100	"	
798-2	"	Lopp & Beuer	Sloan 1	900	Ground Surface	
320-8	"	Morton & Dolley	Doug 1, 2	440	Unlined Sump	
320-7	"	"	Warren 1, 2	380	"	
320-6	"	"	Ster 1, Wells 28	600	"	
320-5	"	"	United 1, 2	320	"	
320-4	"	"	Whitelaw 1	50	"	
320-3	"	"	Birton 1	225	"	
321-4	"	"	Coast line 1, 2	250	"	
321-3	"	"	Meeker 2	120	"	
320-9	"	"	Wells 29, 30	500	"	
320-10	"	"	Wells 53	35	"	
310-4	"	Neaves Petroleum	Cap. 1, 2	500	"	
320-15	"	J. L. O'donnell	# 84	50	"	
320-13	"	"	# 85	30	"	
310-2	"	"	# 80 & 82	100	"	
310-2	"	"	# 81 & 83	100	"	
310-3	"	"	72	30	Seepage Pit	
310-4	"	"	74, 76.	15	"	
300-4	"	"	70, 71.	240	"	
320-2	"	Ruchti Oil	4, 5, 6	850	"	
311-2	"	Vesta Petroleum	P V 1, 2	50	Unlined Sump	
310-5	"	Wagoner Oil	# 8	40	"	
320-11	"	West. Emp. Petr.	Phil. 1, 2, 3	60	"	
320-12	"	Westkern Oil	Stone 1, 2, 3, 5	430	Seepage Pit	Some to gr.
311-1	"	Wilbur, V.R.G.	Fig. 1	20	Unlined Sump	
321-1	"	"	Fig. 2	20	"	
321-2	"	"	Ranger 1	20	"	

TABLE I - CONT'D

LOCATION (Plate I)	JURISDICTION	DISCHARGER	OIL WELL	JUAN. BRINE BBLs/MO	TYPE DISPOSAL	REMARKS
789-4	County Engineer	J. N. Routh (Palm Oil - 4-54)	Hopkins 1, Stephens Man	25	Unlined Sump	Dischg. stopped 4-1-54
746-1	" "	Pacific Amer.	5 Wells	600	Part dischg. to sump in Torr.	Sump dischg. stopped 4-1-
300-5	" "	Ring Oil Company	2 Wells	300	Reinjection	No injection well permit Corrected 4-1-54 (Sew.)
789-5	" "	Secunda Oil	Angelich 1	20	Unlined Sump	Corrected 4-17-54

TABLE 1A

TORRANCE AREA INDUSTRIAL WASTE SURVEY  
Industrial Waste Discharges to Ground (other than oil brines)

LOCATION (Plate I)	JULIS- DICTION	DISCHARGER	WASTE	VOLUME	DISPOSAL	REMARKS
769-1	Torrance-RWPCB#4	National Elec.Prod.	Plating Waste	25000-50000 gpd	Lagoons	Poll.source-Recom. disch.reqmts.
769-2	"	"	Dom.sew.&water soft.wastes	40 Employees	Lagoon & septic tank	Poll.source-Recom. disch.reqmts.
786-2	"	Columbia Steel	Pickling liquor	7-12 gpm	Held in unlined sump before sewering	Poll.source-Recom. imperv.holding tank
796-1	"	National Supply	Zeol.Regen.brine	300#/NaCl/wk.	56' Seepage Pit w/ overflow to slough	Poll.source-Recom. disch.reqmts.
796-2	"	"	Elec.Furn.Smog control wash Sand blasting dust coll.wash,waste oil	3000 gals/wk  Varies	"  To pit on proper- ty.Periodically hauled to dump.	Poll.source-Recom. disch.reqmts.  No pollution problem
785-2	"	American Radiator	Glazing solution	Varies-average 100 gpd	Ground surface E/ of Pueblo area of Torrance	Possible future pro- blem, Unsightliness Rec.surveillance
785-1	"	General Petroleum	Refinery area surface runoff	700 plus acre area	Through oil skim- mer & then to low ground E/of Pueblo area of Torrance	Possible future nuisance-Rec.sur- veillance.
786-1	"	Felker Mfg. Co.	Plating wastes	Very small	To ground & street	Insign.vol. Waste to be sewered

TABLE 1A - CONT'D

LOCATION (Plate I)	JURIS- DICTION	DISCHARGER	WASTE	VOLUME	DISPOSAL	REMARKS
756-2	Torrance-RMPCB#4	Chicago Bridge	Steam cleaning wastes	Small-intermittent operation	Spread on ground	Insign. volume
787-4	"	Naval Supply Depot	Refrig. coil defrost	Less than 1000gpd	Storm drain	No poll. problem
787-2	"	D & M Mach. wks.	Cooling water	Small	Overflow to gr.	Insign. volume
785-3	"	Amer. Rock Wool	Fume Arrestor wash	40,000 gpd	Lagoons	Sewered as of 1-1-54
N 705-1 N 705-2	RB- WFB#4	S.C. Edison #1 SC #2 proposed	Stm. Plant Waste	Large	Pacific Ocean	Satisfactory disp. Disch. reqmts. set
	County Engineer	Aircraft Magnesium Corporation	Slag	5 TON/wk.	Amer. DISP. Co. Dump	Approved Disposal
	"	Associated Pipe	Zeolite Regen. brine	110 gph	Hauled	Co. I.V. Permit
	"	Dow Chemical	Process wastes	175 gpm	Dominguez Chan.	" " "
	"	" "	Acid sludge	2500 tons/yr.	Ocean disposal	Approved disposal
	"	" "	Caustic sludge	80 bbls/yr.	Adams dump	" "
	"	" "	Tank bottoms, oil sludge, etc.	Varies	" "	" "
	"	Fletcher Oil Co.	Acid sludge	175 bbls/mo.	Ocean disposal	" "
	"	" "	Caustic sludge	350 " "	" "	" "
	"	HTM Metals Salvage	Alum slag	-	Amer. Slag Co.	" "

TABLE 1A - CONT'D

LOCATION (Plate I)	JURIS- DICTION	DISCHARGER	WASTE	VOLUME	DISPOSAL	REMARKS
	County Engineer	Midland Rubber	Process Wastes	800 gpm	Dominguez Chan.	Co.I.W.Permit
	" "	" "	Solid wastes	-	Adams Dump	Approved Disp.
	" "	Shell Chemical	Process wastes	1100 gpm	Dominguez Chann.	Co.I.W.Permit
	" "	" "	Lime slurry	26 T/mo.	C&O, TCL, or Hard- wick Dump	Approved disposal
	" "	" "	Muchar-filter material	7500 cu.ft./yr.	Dump	" "
724-1	City of Los Angeles	Harvey Machine	Cooling water	10 gpm	Dom.Chann.City LA Permit	No poll hazard under LA Co.Per.
724-4	RB - WPB #4	City of Redondo	Munic.Refuse	City Redondo	Landfill dump	
724-5	Torr.-R/PCB/#4	Green	" "	-	Cut and cover dump	
755-3	" "	City of Torrance	" "	City Torrance	Fill and cover	Disch.recmts. set
250-1	" "	K.S. Senness	Oil sump waste	presently inact.		Disch.recmts. set
301-1	City of Los Angeles	City Disposal, Inc.	General	-	Landfill dump	City of LA Permit
272-1	County of LA	Palos Verdes Dump	General I.W.	see remarks	"	Not operating
747-2	Torr.- R/PCB/#4	Palos Verdes Dairy	Dairy Wastes	3000 gpd	4 acre open drainage field	Wastes confined to property
255-4	" "	Inglewood Farms	Dairy & Creamery wastes	5000 gpd	2 acre open drain- age field	"

TABLE IA - CONT'D

LOCATION (Plate I)	JURIS- DICTION	DISCHARGER	WASTE	VOLUME	DISPOSAL	REMARKS
245-7	Torr. RWPCB #4	Colnbrook Dairy	Dairy Wastes	3400 gpd	4 acre drainage field	Waste confined to property
819-1	RWPCB #4	LA Co. Sanitation Dist.	Sewage treatment plant screenings	-	Cut and cover	Satisfactory disposal
			Digested sludge	-	Drying beds	Sold for fertilizer

TABLE II - RECENT WELL ANALYSIS (Cont'd)

WELL NO.	PROD. ZONE	DATE SAMP.	pH	EC $\times 10^6$	B	HCO <sub>3</sub>	Cl	PPM SO <sub>4</sub>	Ca	Mg	Na+K (Na)	ANAL. FROM
746	400,S	7-11-52		1250		232	305	9	67	27	153	WR
"	"	9-14-53	8.2	1418		246	324	6				FC
747D	"	10-20-53	7.5	676	.2	288	81	1	31	11	109	WR
748	"	7-2-52	7.5	680		256	110	11	32	17	109	"
748B*	"	9-22-53	7.8	709	.18	270	94	.6	32	16	89	WFB#4
749A	"	4-16-53	8.1	1080	.16		142	37	74	38	96	WR
749L*	"	9-22-53	7.8	1080	.27	441	146	6.3	72	34	112	WFB#4
757N*	S	2-10-53		4500		665	9650	0	316	100	5500 +	"
"	"	2-2-53		880		216	186		32	12	170 +	"
759C	400,S	9-22-53	7.9	714	.16	314	78	.8	26	27	92	"
764A	G,400,S	6 - 53	7.9			238	42	23	47	12	55	GP
"	"	11-19-53	8.0	521	.10	242	40	12	46	12	51	WR
764B	"	6 - 53	7.9			227	57	30	50	12	60	GP
764E	"	"	8.0			241	62	21	50	15	65	"
766	"	10-21-53	7.6	607	.22	264	71	tr	41	13	76	WR
769	200,400S	10-21-53	7.5	658	.48	267	77	tr	25	11	103	"
769D	400,S	4-16-53	8.0	630	.1	293	64	0	24	13	100	"
776	G,400,S	10-21-53	7.7	650	.11	249	82	11	42	20	72	"
779A	400,S	12-5-52	8.7	630		305	42		14	8	118	"
785C	G,400,S	10-21-53	8.0	781	.12	244	119	49	68	19	85	"
739	400,S	5-15-52	8.6	540	.13	60		tr	22	8	109	"
789C	"	12-5-53	8.4	600		64			22	8	99	"
794A	S	10-21-53	7.8	472	.1	227	25	22	42	11	45	"
794C	"	9-8-53	8.0	484	.16	220	31	32	44	10	47	W&P
795	"	9-24-53	8.1	486	.14	216	26	34	40	12	52	"
795C	200,400,S	9-8-53	8.0	530	.15	240	47	0	25	8	83	"
798F	200	1-2-51	7.7	8270		244	3394					WR
"	"	5-6-52	7.4	11700		305	4240					"
"	"	12-2-52	7.6	12500		195	4750					"
798G	"	1-2-51	7.6	3260		287	792					"
799B	400,S	9-8-53	7.1	520	.12	276	34	1.2	21	6	92	"
808	"	5-20-52	7.9	380	.04		21	2	28	11	49	"
808B	"	11-5-53	7.5	438	.1	220	21	2	22	11	59	"
809	200	11-20-52	7.7	500		244	35		21	16	65	"
809B	400,S	11-20-52		450		238	21		20	15	58	"

TABLE II

TORRANCE AREA INDUSTRIAL WASTE SURVEY  
Recent Water Well Analyses

WELL NO.	PROD. ZONE	DATE SAMP.	pH	ECx10 <sup>6</sup>	B	HCO <sub>3</sub>	Cl	PPM SO <sub>4</sub>	Ca	Mg	Na+K (Na)	ANAL. FROM
250C	200,400S	12-19-51		720		305	85					WR
250D	"	11-24-52	7.7	940		372	131	35	76	39	96	"
250H	"	3-26-53	7.8	1050		406	136	24	74	35	103	"
260A	"	12-19-51	7.7	770		403	107	19	65	27	104	"
271	"	10-21-53	7.6	939	.38	359	129	tr	60	20	114	"
271A	"	"	7.6	1070	.20	372	138	42	73	27	122	"
281	"	10-3-51		1010	.4		142	4	56	21	151	"
281B	"	11-5-53	7.9	1213	.38	410	156	62	66	22	168	"
281F*	"	9-22-53	7.7	1450	.33	334	170	255	123	37	135	"
290	"	9-8-53	7.6	935	.14	258	181	2.6	66	12	122	RWPCA
300E	UP	5-8-52	7.7	500		311	39	1	32	13	77	W&P
301	400,S	11-5-53	8.1	721	.4	342	80	2	27	5	147	WR
310C	"	8-26-52	7.9	790	.09	244	114	22	51	13	89	"
"	"	11 - 52	8.1	440	.13	220	35	7	24	9	61	"
311B	"	"	8.0	558	.17	276	50	1	21	8	96	W&P
320C	"	"	8.2	420	.19	216	29	1	19	7	66	"
320E	"	"	8.1	416	.19	220	31	3	20	7	61	"
712	"	3-20-53	8.1	666		249	66	39	59	16	62	"
712A	"	3-30-53	8.1	662		245	66	41	60	15	61	CWSC
712B	"	2-12-53	7.4	666		248	62	39	55	15	64	"
712C	"	3-30-53	7.8	632		254	55	36	56	14	60	"
712G	"	"	7.9	636		246	55	41	61	13	56	"
725F	G.400,S	8-19-53	7.3	412		167	29	1	29	8		"
732	"	3-30-53	7.9	608		246	55	31	54	14	57	"
737B	400,S	9-14-53	8.3	708		294	86	6.6				"
737C	200,400,S	"	8.5	780			96	2	42	14	116	FC
743E	G	1-3-52	8.2	420			39					WR
743G	"	4-15-53	8.2	510	.12	250	46	1	42	15	50	"
743S	"	6-16-52	8.5	440	.1		39	4	38	11	52	"
744A	G.400,S	5-26-52	8.2			218	103					"
744B	"	12-5-52	8.1	540	.14	232	67	11	45	21	52	"
744C	"	12-5-52	8.0	490	.2	232	50	3	41	17	50	"

TABLE II - RECENT WELL ANALYSES - (Cont'd)

WELL NO.	PROD. ZONE	DATE SAMP.	pH	ECx10 <sup>6</sup>	B	PPM					Na+K (Na)	ANAL. FROM
						HCO <sub>3</sub>	Cl	SO <sub>4</sub>	Ca	Mg		
809E	400,S	5-20-52	8.0	820			160	25	60	14	109	WR
814	SP	1-4-54	8.0	1728		234	228	338	169	36	133	FC
814A	"	1-4-54	8.2	1011		142	87	80	87	22	46	"
816	S	11-20-52	7.7	470	.16		21	6	25	13	60	WR
818B	400,S	10-21-53	8.0	471	.16	222	25	28	38	13	45	"
818E	"	11-20-52	8.3	1030			234	34	88	25	102	"
819	200,400,S	11-20-52	8.4	520	.17		50	19	35	17	67	"
829	400,S	11-21-52	8.5	420	.11		27	12	28	14	55	"
829F	"	11-21-52	7.8	420	.14		32	0	22	13	59	"
829G	-	5-29-52	7.9	710	.12	238	135	2	66	14	74	"
829H	-	5-29-52	8.2	420	.10		43	1	25	9	69	"
829J	200	6-6-52	7.7	380	.15	238	21	1	22	8	78	"
"	"	1-5-53	7.4	597		214	32	10				FC

NOTES: Well Numbers marked with asterisk indicate temporary county well number used.

Abbreviations: RWPCB 4    Regional Water Pollution Control Board No. 4  
 WR                    State Division of Water Resources  
 FC                    Los Angeles County Flood Control District  
 CWSC                  California Water Service Company  
 GP                    General Petroleum Corporation

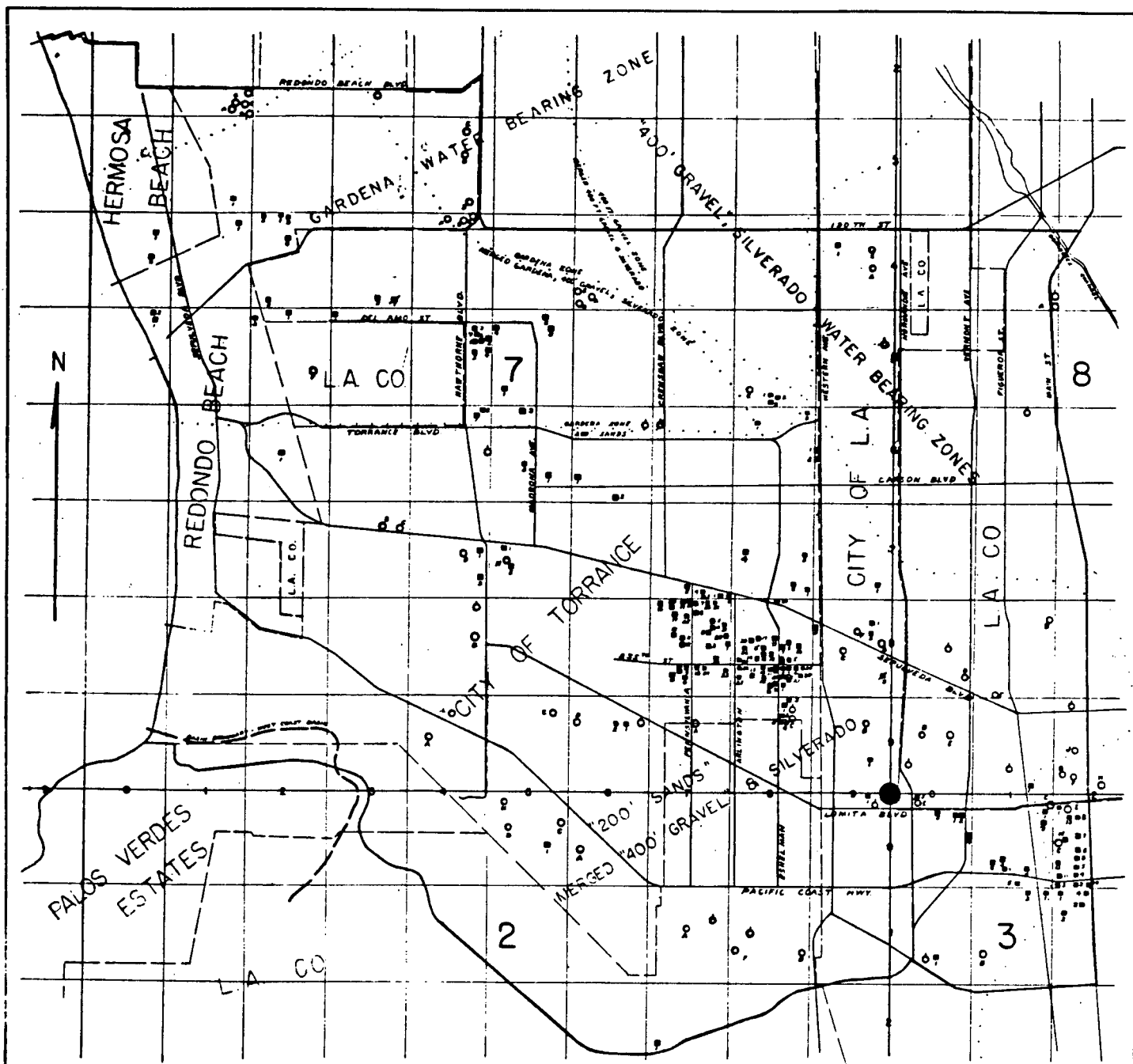
TABIE III

TORRANCE AREA INDUSTRIAL WASTE SURVEY  
Major Industrial Wastes Discharged to Sewer System

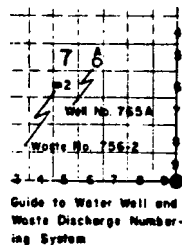
<u>DISCHARGER</u>	<u>ADDRESS</u>	<u>WASTE</u>	<u>QUANTITY</u>
CCND	51 Oil Wells	Oil Brine	14,500 bbls/mo
Del Amo Oil	54 " "	" "	7,500 " "
Doak Aircraft	22309 S. Western	Metal Cleaning	-
Dow Chemical	305 Crenshaw	Softening, Cooling	-
Longren Aircraft	2576 W. Carson	Metal cleaning	-
Mayfair Creamery	2031 S Western	Creamery wastes	-
Mido Corporation	1801 Border	Chemical cleaners	-
North American Aviation	2321 Abalone	Metal cleaning	-
Pacific Electric	Dominguez & Madrid	Car wash	-
Pacific Smelting	22219 S Western	Wash water	-
Robinet	No. 1 Oil well	Oil brine	300 " "
"	No. 7 Oil well	Oil brine	300 " "
Rome Cable	1739- 213th Street	Pickling waste-cooling water	-
Standard Oil	51 Oil wells	Oil brine	24,000 " "
Texas Company	#7, #9, #10 Oil wells	Oil brine	2,880 " "
Torrance Brass Foundry	1825 - 213th Street	Mold quenching	-
Simmons Oil	24 Oil wells	Oil brine	1,800 " "

TABLE III - Cont'd

<u>DISCHARGER</u>	<u>ADDRESS</u>	<u>WASTE</u>	<u>QUANTITY</u>
California Handprints	700 - 15th Street	Process Water	-
Mar Vista Oil	#1 & #3 Wells	Oil brine	100 bbls/mo
Marble Petroleum	# 101 Oil well	Oil brine	300 " "
Advance Manufacturing	1214 W. 254th	Metal cleaning, cooling water	-
Malleable Fittings	1040 W. Lomita	Cooling water, smog arrestor water	2200 gpd
Standard Oil Absorption	Sepulveda & Western	Cooling tower blowdown	300 gph
6 Douglas Aircraft	19601 S. Normandie	Metal cleaning	600 gpm
Harvey Machine Company	19201 S. Western	Metal cleaning, plating	10 gpm
Montrose Chemical	20201 S. Normandie	Process & wash water	300 gpm
Lomita Auto Parts	2032 W. Pacific Coast Highway	Caustic	-
Barneys Car Wash	25825 S. Norbonne	Detergent	-
Electro-Plating Engineering	1201 E. Ocean	Acid, caustic	-



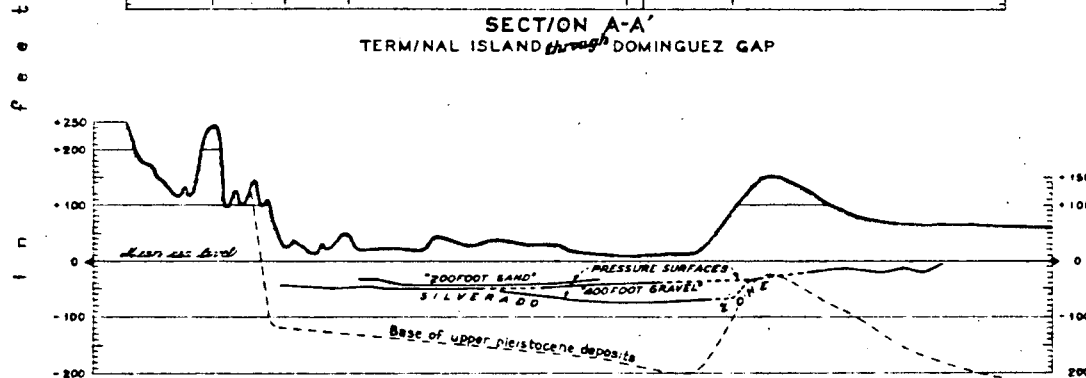
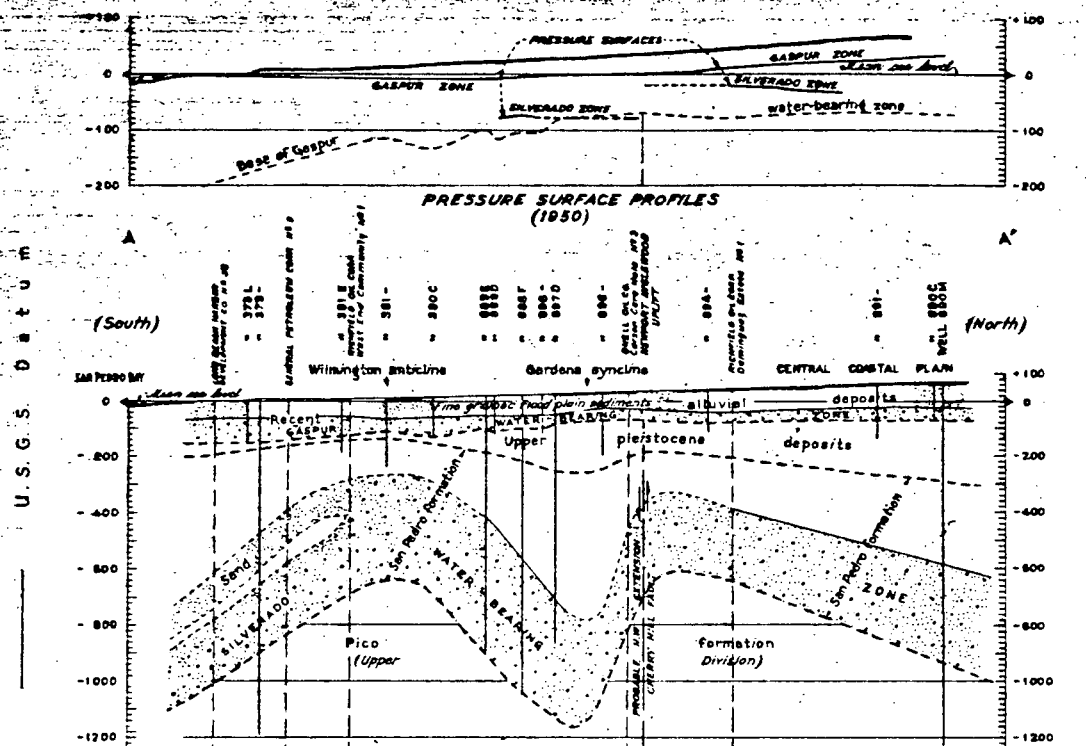
- - Water Well
- - Existing Oil Waste Discharge
- - Industrial Waste Discharge
- - Oil Waste Discharge Well
- - Day
- - Jurisdictional Boundary
- - Survey Boundary
- ..... - Approximate Boundary of Water Bearing Zone



## MAP OF TORRANCE INDUSTRIAL WASTE SURVEY AREA

SHOWING SURVEY BOUNDARY, JURISDICTIONAL BOUNDARIES, LOCATION OF INDUSTRIAL WASTE DISCHARGES, LOCATION OF RECENTLY SAMPLED WATER WELLS, AND APPROXIMATE BOUNDARIES OF UNDERGROUND WATER BEARING ZONES

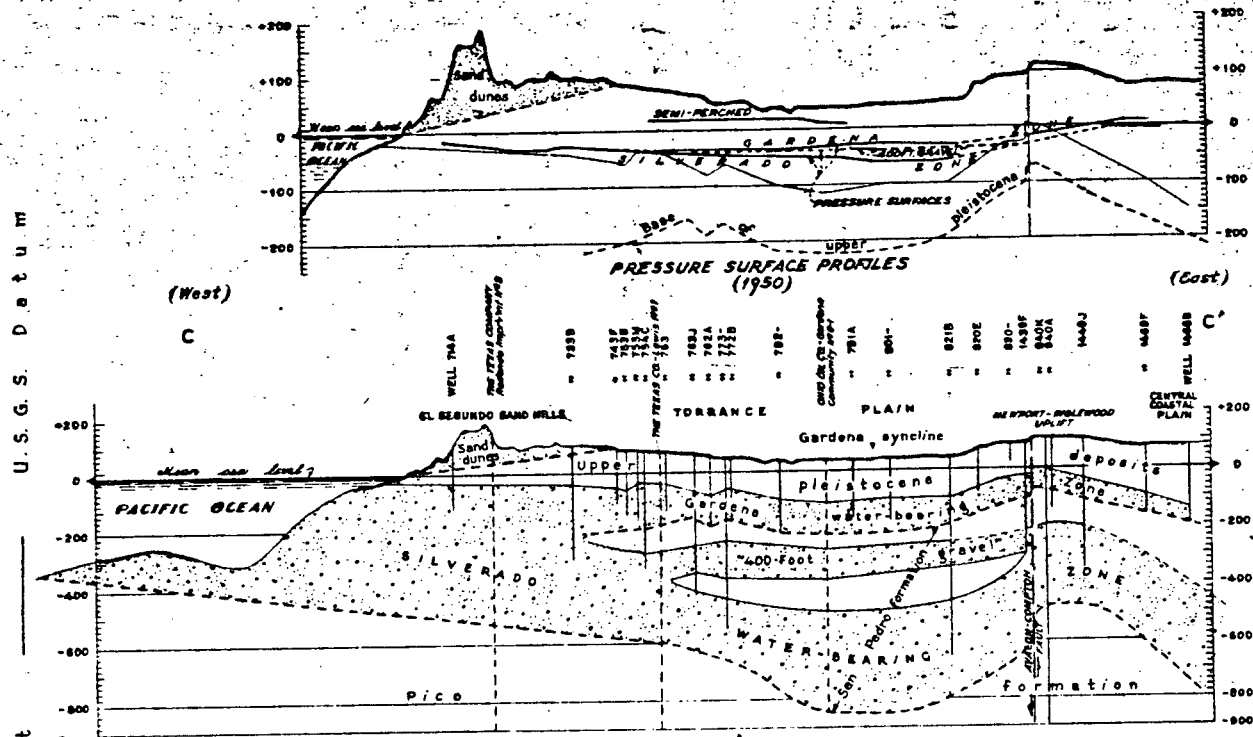




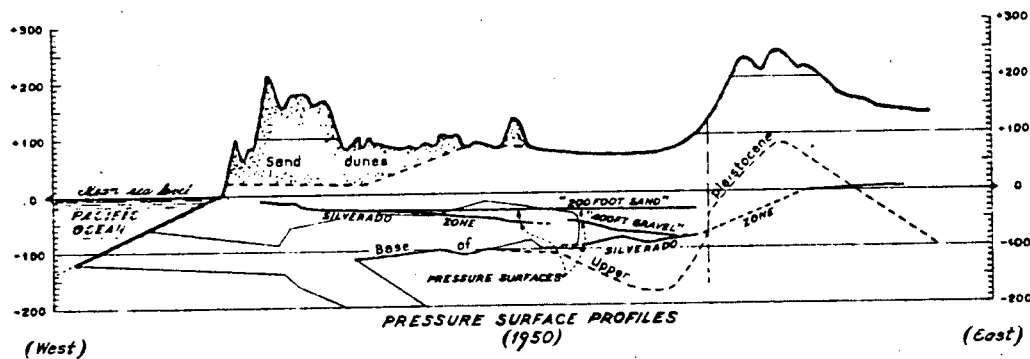
# GEOLOGIC SECTIONS A-A' and B-B'

DIVISION OF WATER RESOURCES

TWO MILES



SECTION C-C'  
HERMOSA BEACH to NORTH COMPTON



SECTION D-D'  
MANHATTAN BEACH to HUNTINGTON PARK

# GEOLOGIC SECTIONS C-C' and D-D'

DIVISION OF WATER RESOURCES

TWO MILES

Water Well  
Oil Well

E  
U.S.G.S. Data

feet

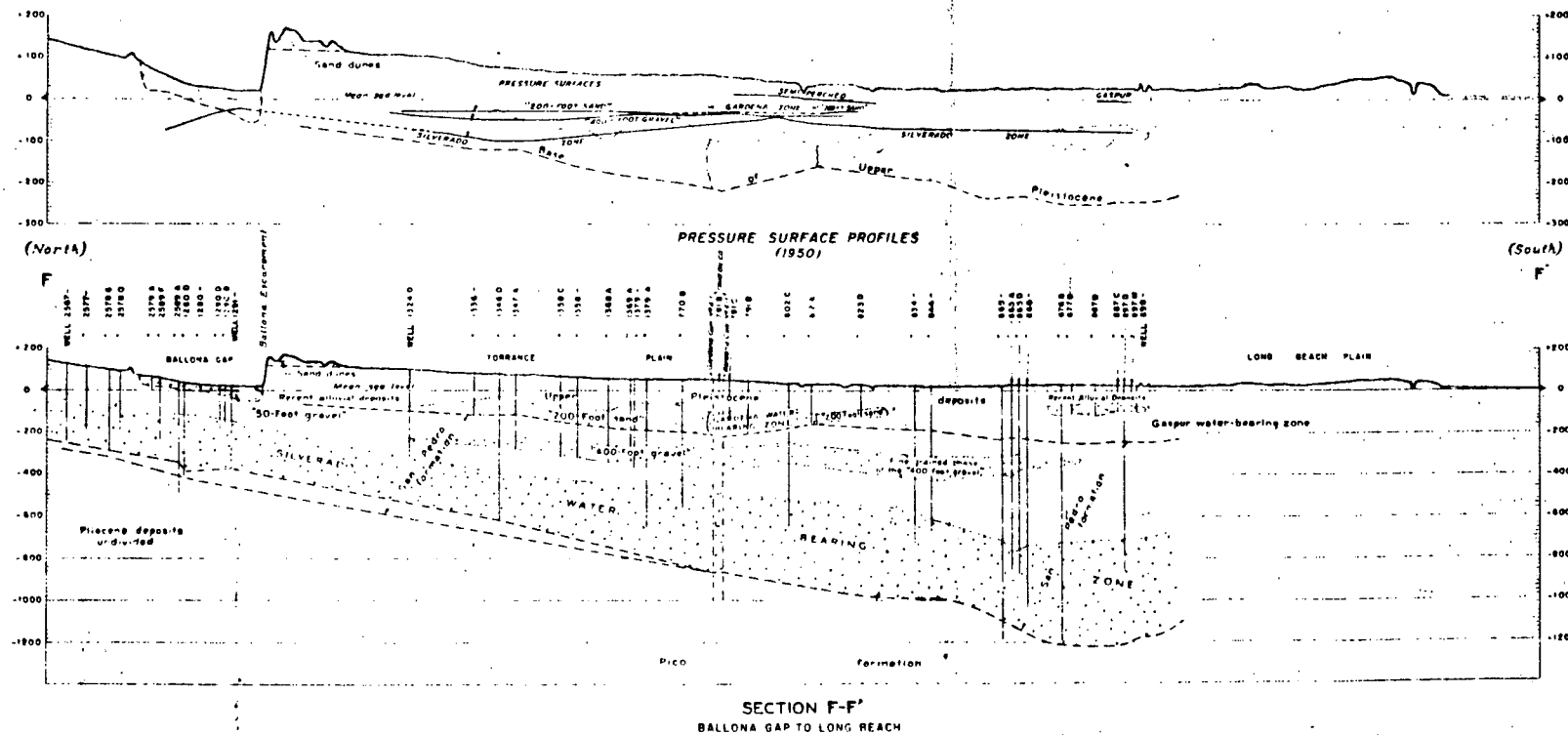
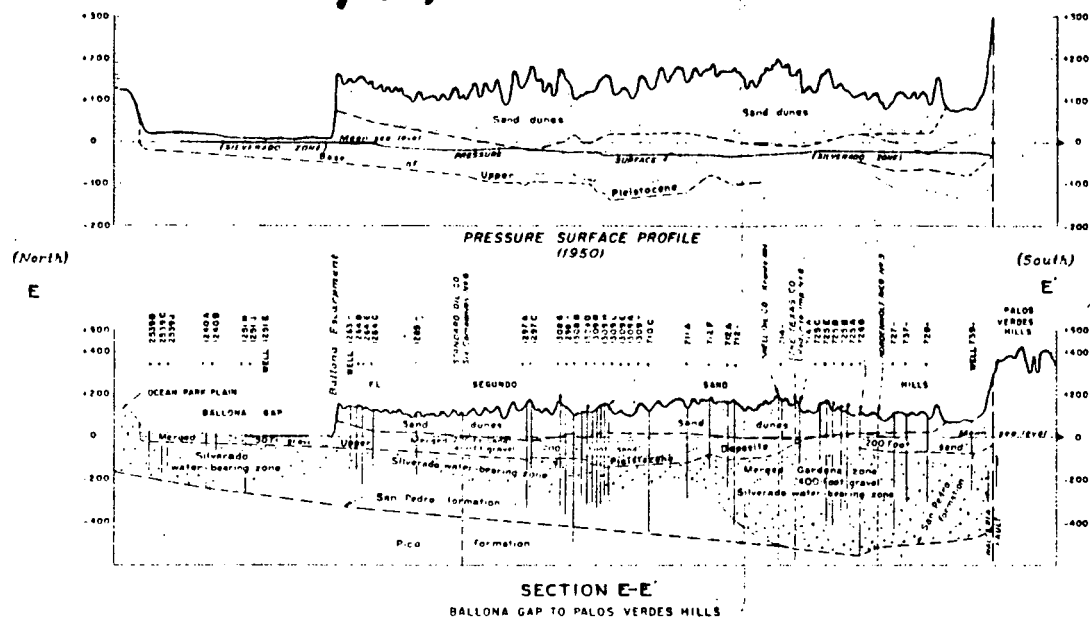
E

U.S.G.S. Data

F

feet

F



GEOLOGIC SECTIONS E-E' and F-F'

100 FEET

DIVISION OF WATER RESOURCES

EXHIBIT "D"

I, Laurence L. Harvey, Executive Officer for the Los  
Angeles County Sheriffs Department, State of  
California, do hereby certify that the foregoing is a  
true and correct copy of a report of the staff of the Sheriff's  
Department on the Lawrence, Green & Associates  
Harvey, 1812 Broadway, Los Angeles, California.

February 10, 1959  
Date

Laurence L. Harvey  
Executive Officer